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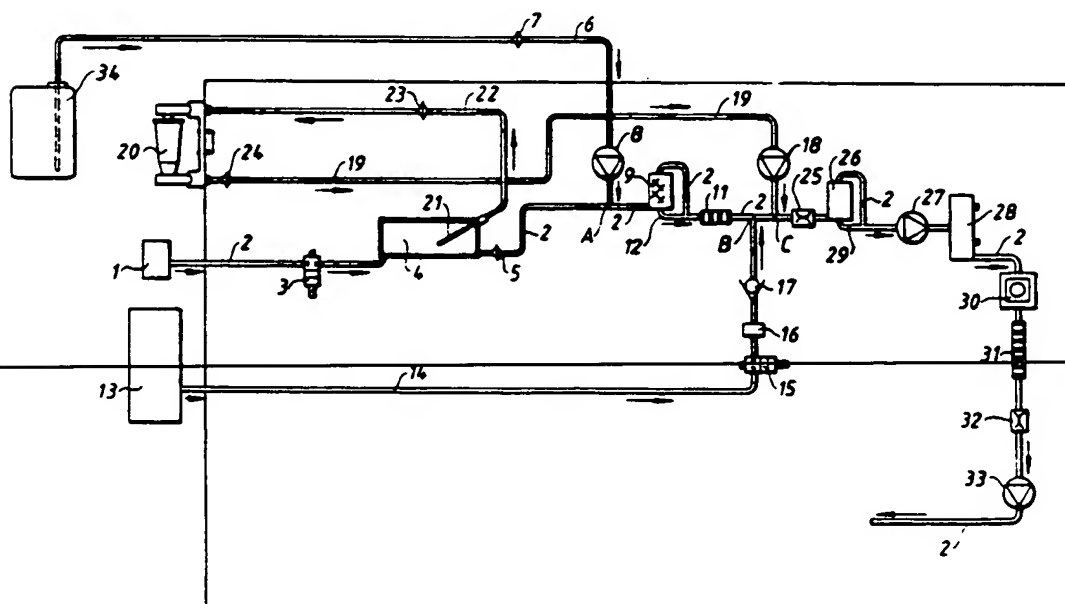
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(54) Method and system for preparation of a medical solution, for example a dialysis solution.

(57) The present invention relates to a method and a system for preparation of a medical solution, for example a dialysis solution, from water and a plurality of concentrates, including an acid, whereby respective concentrates are supplied successively to a number of dosage points (A,B,C) along a main con-

duit (2) which leads from a water source (1) to a point of consumption, such as a dialyzer.

The method is characterized in that acid is supplied in gas form and the system is characterized in that one of said dosage points (A,B,C) constitutes a gas inlet for the intake of said acid in gas form.



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ity of concentrates, including an acid, whereby respective concentrates are arranged to be supplied successively to a number of dosage points along a main conduit which leads from a water source to a point of consumption, such as a dialyzer. The system is characterized in that one of said dosage points constitutes a gas inlet for the intake of said acid in gas form.

The invention is preferably intended to be applied to a system adapted for use for dialysis with sodium bicarbonate as the buffer and to which calcium is also supplied. In such a case, the dosage inlet point for the acid in gas form should be positioned between the dosage points for these substances.

The system preferably includes means for measuring the pH-value after the addition of gas. Other measuring devices can however also be used, such as a conductivity meter.

Considerable advantages are attained if the system includes means for preparation of the acid in gas form in situ, such as a device for preparation of CO<sub>2</sub>. Other gases can however also be used, such as hydrochloric acid in gas form.

#### BRIEF DESCRIPTION OF THE DRAWING

In the attached drawing a system or a plant for preparation of a medical solution, preferably a dialysis solution, is shown in simple block form. For the sake of clarity, less important details for the invention have been omitted.

#### PREFERRED EMBODIMENT OF A SYSTEM ACCORDING TO THE INVENTION

A preferred embodiment of a system according to the invention is hereby shown in the drawing. In the drawing, water is supplied from a source 1, for example a reverseosmosis unit. Alternatively, the source 1 can constitute a hospital's central system in which water has already been supplied with one or more concentrates in fixed concentrations. In the following, the expression water source is meant not solely a source for pure water, but also sources for water to which one or more substances have been added. The water is fed via a main conduit 2 with a valve 3 to a heating vessel 4, where it is heated to a temperature, for example circa 37° C. The main conduit 2 then continues via a filter 5 to a mixing point A. A liquid-based concentrate is supplied from a reservoir 34 via a conduit 6 with a filter 7. Alternatively, this concentrate can be supplied in powder form and dissolved in situ by water from the water source 1 being fed therethrough, as is described for example in the above-mentioned American patent 4 784 495 or in the Swedish patent application 90.00586-9. The concentrate

from the source 34 or concentrate prepared in the above-mentioned way is supplied to the main conduit 2 with the aid of a pump 8.

In order to achieve good mixing, the water and concentrate are fed to a mixing vessel 9 and from there to a conductivity meter 11. So that the mixing vessel 9 can be emptied after treatment has been carried out, it is provided with a separate drainage conduit 12 at its base. The conductivity meter 11 is appropriately arranged to control the pump 8 in order to achieve the correct mixing ratio between water and concentrate.

According to the invention, a concentrate is supplied to the main conduit 2 in the form of a gaseous acid. This acid is drawn from a reservoir 13 therefor. This reservoir 13 can either consist of a gas bottle with suitable gas, for example carbon dioxide or HCl in gas form. Alternatively, it can consist of a device for preparing the gas in situ. By way of example, CO<sub>2</sub> can be prepared in situ by means of a carbonate, preferably sodium carbonate, being mixed with acid and water. An example of a suitable acid for this purpose is citric acid. Alternatively, CO<sub>2</sub> can be prepared by warming a carbonate, preferably sodium carbonate, to a suitable temperature, such as over 50° C.

The gas from the reservoir 13 is then led through a conduit 14, a valve 15, a flow regulation valve 16 and a non-return valve 17 to a mixing point B in the main conduit 2.

A third concentrate from a reservoir 20 in the form of a powder cartridge is then supplied to a point C in the main conduit with the aid of a pump 18 via conduit 19. The powder therein is dissolved continuously by water being drawn from the heating vessel via a tube 21 and a conduit 22 with a filter 23. The conduit 19 also includes a filter which is designated by 24. The dissolving of the powder in the cartridge 20 can occur in a way as described in the above-mentioned American patent 4 784 495.

The prepared liquid is delivered from the mixing point C via a throttle 25 and bubble chamber 26 with the aid of a pump 27 to a bubble trap 28. Through this arrangement, bubbles are formed from mainly air dissolved in the liquid and any surplus gas supplied from the reservoir 13. These bubbles are enlarged in the bubble chamber 26 and removed in the bubble trap 28 in a not shown way. These, together with a smaller quantity of liquid, can possibly be led directly to a drain or may also be recirculated so that surplus gas can also be dissolved. Like the mixing vessel 9, the bubble chamber 26 is also provided with a drainage conduit 29 at its base. Thus, this can be completely emptied when the system, for example, is to be cleaned.

The main conduit 2 extends from the bubble

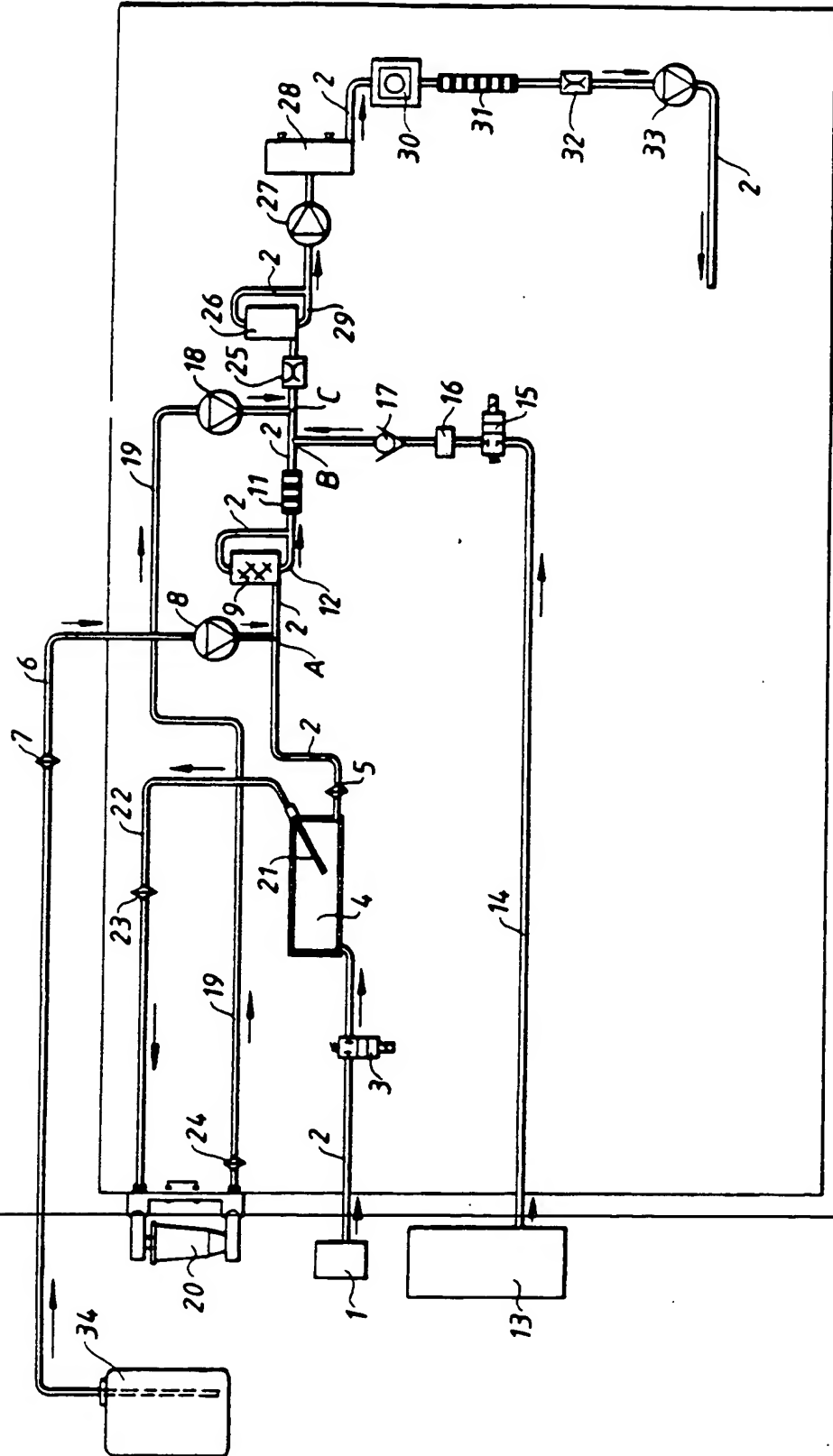
uses bicarbonate as the buffer, characterized in that CO<sub>2</sub> is chosen as the gas.

8. Method according to claim 7, characterized in that CO<sub>2</sub> is prepared in situ by mixing a carbonate, preferably sodium bicarbonate, with acid and water. 5
9. Method according to claim 8, characterized in that citric acid is used for preparation of CO<sub>2</sub>. 10
10. Method according to claim 7, characterized in that CO<sub>2</sub> is prepared in situ by warming a carbonate, preferably sodium bicarbonate, to a suitable temperature, for example over 50° C. 15
11. Method according to claim 10, characterized in that water formed during the preparation is separated off before supply to the main conduit. 20
12. System for continuous preparation of a medical solution, for example a dialysis solution, from water and a plurality of concentrates, including an acid, whereby respective concentrates are arranged to be supplied successively to a number of dosage points (A,B,C) along a main conduit (2) which leads from a water source (1) to a point of consumption, such as a dialyzer, characterized in that one of said dosage points (A,B,C) constitutes a gas inlet (B) for the intake of said acid in gas form. 25 30
13. System according to claim 12, adapted for use in dialysis with bicarbonate as the buffer and to which calcium is also supplied, characterized in that the dosage inlet point (B) for the acid in gas form is positioned between the dosage points (A and C) for these substances. 35 40
14. System according to any of claims 12 and 13, characterized by means (30) for measuring the pH-value after the addition of gas. 45
15. System according to any of claims 12-14, characterized by means for preparation of the acid in gas form in situ, such as a device (13) for preparation of CO<sub>2</sub>. 50

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## EUROPEAN SEARCH REPORT

Application Number

EP 91 11 6381

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 209 607 (DIETL) * Page 2, lines 1-6; abstract; figure 1 * -----	1	A 61 M 1/16
A	PATENT ABSTRACTS OF JAPAN, vol. 6, no. 49 (C-096), 31st March 1982; & JP-A-56 164 113 (DAIGO MINORU) 17-12-1981 * The whole document * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 61 M
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 20 December 91	Examiner PAPONE F.
<b>CATEGORY OF CITED DOCUMENTS</b> X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ..... &: member of the same patent family, corresponding document			